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Respiratory Protection: Are our standards protecting worker health?

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Abstract

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“Respiratory Protection: Are our standards protecting worker health?”

A case study with reference to diesel particulate matter

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Aim:

Ultrafine diesel engine emissions are known to cause adverse health impacts including lung cancer, cardiovascular and irritant effects (World Health Organisation 2012). Respiratory protective devices are commonly used to mitigate worker exposure to many hazardous contaminants. Current standards to evaluate penetration through respirator filter media may not consider ultrafine particles due to the diameter of the challenge aerosol and the detection limit of the instrument. Nor do they test penetration at flow rates representative of moderate to heavy work rates.

Methods:

Emissions from a Detroit D706 LTE diesel engine were fed into a purpose built experimental chamber. Penetration was determined by particle count at diameters ranging from 5.6 – 560nm, using an Engine Emissions Particle Sizer (EEPS). Penetration was also measured by mass of Elemental Carbon, using NIOSH 5040. Flow rates ranged from light to heavy, as designated in AS/NZS 1716 (Standards Australia International Ltd & Standards New Zealand 2012) and ISO DIS 16975 – 1.2 Work Rates 2 and 3 (ISO 2015).

Results and Conclusions:

A method has been developed and validated. Initial findings indicate penetration exceeded standards specified limits for filtering efficiency for a number of filters less than 25 - 30nm, when measured as a function of particle count. Penetration was found to increase as flow rate increases. These results were compared to the penetration by mass of elemental carbon through the respirator filters. This research is relevant as it has been postulated that the ultrafine particles may contribute to adverse cardiovascular mortality and morbidity associated with diesel engine emissions (Martinelli, Olivieri & Girelli 2013).